STATE OF NEW HAMPSHIRE

2016 STATE ANTIBIOGRAM

Released:
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New Hampshire Department of Health and Human Services
Division of Public Health Services

The New Hampshire Department of Health and Human Services, Division of Public Health Services (DPHS), Healthcare Associated Infections (HAI) Program has published the first statewide antibiogram for the 2016 calendar year. Antibiograms provide a summary of antibiotic susceptibility patterns for selected bacterial pathogens and antibiotics. Attached are two versions of the statewide antibiogram for non-urine and urine source isolates that have been reported from New Hampshire's hospitals. The first version shows the percent susceptibility, while the second shows the total number of isolates in the numerator and denominator that corresponds to each percent susceptible value. Methodology and data limitations can be found in the Appendix at the end of the document.

Purpose:

- The antibiotic susceptibility information contained in these antibiograms can be used by clinicians to choose appropriate empiric antibiotics to treat common infectious syndromes and avoid overuse of broad spectrum antibiotics. Antibiotics should be chosen based on the clinical syndrome and the most likely pathogen(s) associated with the clinical syndrome. Below we have outlined some general guidance to help clinicians make informed decisions around antibiotic choice.
- Annual analysis of hospital antibiotic resistance data will allow the New Hampshire DPHS to evaluate temporal trends and geographic patterns of antibiotic resistance in New Hampshire to guide antibiotic stewardship efforts at the local, regional, and state level. Antibiotic stewardship refers to the implementation of coordinated efforts to promote the appropriate use of antibiotics in order to improve patient outcomes, reduce antibiotic resistance, and prevent the spread of multidrug-resistant organisms.

Clinical Implications:

The recommendations below serve as guidance to clinicians treating patients empirically (before culture results are back) for some of the most common infections encountered in patient care. Each patient should be treated based on a clinician's assessment of the type of infection and acuity, and a patient's antibiotic regimen should always be tailored to culture results once they return.

Uncomplicated Urinary Tract Infections (UTIs)

- Asymptomatic bacteriuria should not be treated with antibiotics in most cases. In some cases, treatment may be indicated including during pregnancy, before certain urologic procedures, and in first three months after renal transplant.
- The most common Gram-negative bacteria to be isolated from urine were *Escherichia coli* (70% of isolates) followed by *Klebsiella* spp. (15%) and *Proteus mirabilis* (5%). *Pseudomonas aeruginosa* was only cultured in 3.5% of urine specimens.
- Nitrofurantoin remains the most likely active agent against *Escherichia coli* (98% susceptible), followed by cephalexin (predicted by cefazolin, 91% susceptible). Trimethoprim-sulfamethoxazole and ciprofloxacin are less likely to be active, and we recommend avoiding ciprofloxacin as first-line therapy because of the potential for toxicity and *Clostridium difficile* infection.

- Fosfomycin may also be considered for *E.coli* (and enterococcal) UTIs. While most hospital laboratories do not routinely test susceptibilities for this antibiotic, testing can be requested. *E. coli* fosfomycin susceptibilities are >90% in national data.

Community Acquired Pneumonia (CAP)

- 32% of *Streptococcus pneumoniae* (pneumococcus) isolates overall are resistant to azithromycin (predicted by erythromycin susceptibility). As a result, azithromycin should not be prescribed when there is concern for pneumococcal pneumonia (e.g. when the syndrome is acute and/or focal consolidation is evident on the chest X-ray).
- National data shows that 44% of outpatient prescriptions are written for acute respiratory conditions, at least half of which are viral and won't respond to antibiotics (JAMA 2016; 315:1864-73). As the number one antibiotic prescribed in the outpatient setting is azithromycin, it is critical to reduce unnecessary use to prevent further resistance from developing in the community (Clinical Infectious Disease 2015; 60:1308-16).
- Preferred agents to treat an acute outpatient bacterial pneumonia suspected due to *Streptococcus pneumoniae* include amoxicillin, amoxicillin-clavulanate, and cefuroxime.
- The respiratory fluoroquinolones (levofloxacin and moxifloxacin) remain highly active against *Streptococcus pneumoniae*, however quinolones should typically be avoided in treating outpatient CAP given the toxicities of the class, their ability to cause *Clostridium difficile* infection even months after antibiotics have ended, and the availability of alternatives. The U.S. Food and Drug Administration (FDA) Drug Safety Communication now advises restricting fluoroquinolone antibiotic use for certain uncomplicated infections (https://www.fda.gov/Drugs/DrugSafety/ucm500143.htm).
- For patients with community acquired pneumonia that are sick enough to be hospitalized, we recommend treatment with ceftriaxone and either doxycycline or azithromycin (for atypical bacterial pathogens).

Skin and soft tissue infections (SSTIs)/Cellulitis

- Most SSTIs are due to either *Staphylococcus aureus* or streptococcal infection.
- 68% all non-urine *Staphylococcus aureus* isolates were methicillin-sensitive *Staphylococcus aureus* (MSSA). Because the majority of SSTIs will be due to either MSSA or streptococcal infection, treatment with a first generation cephalosporin (e.g. cephalexin or cefazolin) is the recommended empiric treatment for cellulitis. Oxacillin susceptibility predicts cephalosporin and beta-lactam/beta-lactam inhibitor susceptibility.
- In the case of a skin abscess, however, empiric outpatient therapy with either trimethoprim-sulfamethoxazole or doxycycline (98% and 88% susceptible, respectively) is the preferred antibiotic treatment for MRSA SSTIs. This is typically prescribed following incision & drainage of the abscess.
- Clindamycin should not be prescribed empirically for MRSA, because 32% of isolates are resistant.

Intra-abdominal infections

- *E. coli*, *Klebsiella* spp., *Enterobacter* spp., *Proteus* spp., streptococci, and *Bacteroides fragilis* are the most commonly implicated bacterial pathogens in intra-abdominal infections. Enterococci are often present but typically can be ignored, particularly when selecting an empiric regimen. *Pseudomonas aeruginosa* is not a common pathogen in intra-abdominal infections.
- Ampicillin-sulbactam shows poor activity against *E. coli*, so this drug should not be used empirically for mixed aerobic-anaerobic intra-abdominal infections, particularly for infections requiring hospitalization.

- Ceftriaxone (a third-generation cephalosporin) maintains good activity against *E. coli* and *Klebsiella* isolates, which together make up about 50% of the Gram-negative bacteria cultured from non-urine sources. Thus, ceftriaxone plus metronidazole is a reasonable empiric inpatient regimen for intra-abdominal infections.
- For serious, life-threatening intra-abdominal infections, piperacillin/tazobactam or cefepime plus metronidazole maintain high activity against the primary pathogens listed above.

Healthcare-associated Gram negative aerobic infections

- Meropenem remains remarkably active against Enterobacteriaceae. The rates of carbapenem-resistant Enterobacteriaceae (CRE) in the state are very low. We recommend that antimicrobial stewardship programs continue to restrict the use of carbapenem antibiotics, as healthcare settings with more liberal use of carbapenems have seen a more rapid rise in carbapenem-resistance.
- Mild-to-moderate infections caused by extended spectrum beta-lactamase (ESBL) producing bacteria (e.g., uncomplicated urinary tract infections caused by ESBL *E. coli*) do not always require treatment with a carbapenem. Alternatives include: trimethoprim-sulfamethoxazole (Bactrim), nitrofurantoin, fosfomycin, and ciprofloxacin. These alternatives should be considered, when susceptible, to limit the overuse of carbapenem antibiotics and to reduce the potential adverse outcomes from unnecessary intravenous antibiotics.
- *Pseudomonas aeruginosa* is most commonly a healthcare-associated infection, including in catheter-associated urinary tract infections and ventilator-associated pneumonia. The most active antibiotics based on the state antibiogram data are piperacillin-tazobactam, ceftazidime, cefepime, and meropenem. Providers should be aware that 14-17% of isolates are non-susceptible to ciprofloxacin/levofloxacin, and 20% of isolates are non-susceptible to aztreonam (for non-urine isolates). If selecting one of these antibiotics, a combination regimen may be warranted. Among the aminoglycosides, tobramycin remains the most active.

Public Health Implications:

1. The statewide antibiogram was created to compliment, not supersede, the important role of local antibiograms. The statewide antibiogram has the ability to measure antibiotic resistance trends over time and to be used as a baseline to compare local data. Additionally, the antibiogram can be used by healthcare facilities without access to a local antibiograms (i.e. outpatient care, long-term care facilities, assisted living, ambulatory surgery, etc.) to assist with appropriate antibiotic prescribing.
2. NH DPHS will continue to monitor and analyze antibiotic resistance data on a yearly basis and track patterns and trends over time. Future reports will highlight changes in susceptibility patterns and overall state and regional trends.
3. There is a critical need for statewide coordinated antibiotic stewardship efforts. The data reveals expected levels of resistance based on national trends, which have been steadily increasing. https://www.cdc.gov/hai/surveillance/ar-patient-safety-atlas.html. In order to prevent antibiotic resistance, we must promote the appropriate use of antibiotics and slow the spread of multidrug-resistant organisms.
    - For more information on how to develop a stewardship program in your facility, explore the CDC Core Elements of Stewardship resources.
    - The NH DPHS HAI Program is a resource for guidance in developing and strengthening your facilities stewardship program, please contact us at haiprogram@dhhs.nh.gov or (603) 271-4496.

New Hampshire Statewide Antibiogram 2016

All Sources Other Than Urine

Percent Susceptible

Gram Negative Organisms	Total Number of Isolates	Percent Susceptible																								
		Ampicillin	Ampicillin/Sulbactam	Piperacillin/Tazobactam	Cefazolin	Cefuroxime	Cefoxitin	Cefotetan	Ceftriaxone	Ceftazidime	Cefepime	Aztreonam	Ertapenem	Meropenem	Imipenem	Doripenem	Ciprofloxacin	Levofloxacin	Moxifloxacin	Amikacin	Gentamicin	Tobramycin	Tigecycline	Tetracycline	Trimethoprim/Sulfamethoxazo
Escherichia coli	2162	60	63	97	87	90	85	100*	94	93	95	93	100	99	100	100*	83	77	---	92	93	93	100	71	82
Enterobacter aerogenes	117			93					86	84	100	91	100	100	92	100*	99	100	---	100	100	99	95	88	98
Enterobacter cloacae	541			90					82	86	92	87	97	99	96	99*	96	96	---	99	97	97	99	88	91
Klebsiella pneumoniae	875		86	96	93	91	94	100*	97	97	98	97	100	100	99	100*	96	96	---	99	95	94	88	88	90
Klebsiella oxytoca	355		74	97	56	93	97	---	96	97	97	93	100	100	100	100*	99	100	---	99	99	99	100	94	98
Proteus mirabilis	568	73	89	100	87	96	96	---	97	98	97	96	99	100		98*	79	83	---	98	91	93			75
Serratia marcescens	327			85					92	86	100	88	100	100	95	99*	95	95	---	99	98	89	95	7	97
Citrobacter freundii	149			97					85	86	99	87	100	100	98	100*	93	95	---	99	93	94	100	82	87
Morganella morganii	124		7	97			74	---	93	92	98	88	99	99		---	92	95	---	100	95	97	25	20	86
Pseudomonas aeruginosa	1208			96						93	91	80		93	89	94*	86	83		95	85	97			
Acinetobacter baumannii	115		84	77					54	85	81			98	---	---	82	88		95	88	91	---	89	83
Stenotrophomonas maltophilia	315									42								79							94
Haemophilus influenzae	385	68	89*			95			99					---			95*	---	100*					85	68

Gram Positive Organisms	Total Number of Isolates	Penicillin	Ampicillin	Oxacillin	Ampicillin/Sulbactam	Cefazolin	Cefuroxime	Ceftriaxone	Ceftaroline	Levofloxacin	Moxifloxacin	Tetracycline	Trimethoprim/Sulfamethoxazol	Clindamycin	Erythromycin	Vancomycin	Linezolid	Daptomycin	Rifampin
Methicillin-**Sensitive** Staphylococcus aureus (MSSA)	6524	15		100	99	100	---	100	100*	93	96	96	99	83		100	99	100	99
Methicillin-**Resistant** Staphylococcus aureua (MRSA)	3048								100*	55	66	88	98	67		100	99	100	99
Enterococcus faecalis	877	99	99		---											98	99	100	
Enterococcus faecium	149	16	27		---											43	96	93	
Enterococcus spp. *(all hospital data)*	1390	87	89		---											91	99	99	
Coagulase negative staphylococcus	1638	12		56	48	51		51		74	84	85	69	69		100	99	100	99
Streptococcus pneumoniae	439	89	---	---	---		84	93		98	99*	84	86	91	68	100	100*		

	Indicates data have been censored because of intrinsic resistance and/or inappropriate clinical use.
---	Indicates data have been censored because of insufficient sample. CLSI guidelines suggest total isolate counts of less than 30 are excluded.
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New Hampshire Statewide Antibiogram 2016

All Sources Other Than Urine

Total Number of Susceptible Isolates/Total Tested

Gram Negative Organisms	**Total Number of Isolates**	Ampicillin	Ampicillin/Sulbactam	Piperacillin/Tazobactam	Cefazolin	Cefuroxime	Cefoxitin	Cefotetan	Ceftriaxone	Ceftazidime	Cefepime	Aztreonam	Ertapenem	Meropenem	Imipenem	Doripenem	Ciprofloxacin	Levofloxacin	Moxifloxacin	Amikacin	Gentamicin	Tobramycin	Tigecycline	Tetracycline	Trimethoprim/Sulfamethoxazole
Escherichia coli	2162	1223/ 2022	1151/ 1834	2105/ 2162	1770/ 2031	1285/ 1429	1170/ 1369	123/ 123	2020/ 2159	1665/ 1784	2028/ 2134	1498/ 1603	2018/ 2024	1787/ 1800	1176/ 1178	445/ 447*	1782/ 2139	1297/ 1689	---	1416/ 1544	2002/ 2162	1737/ 1866	962/ 964	1074/ 1511	1722/ 2102
Enterobacter aerogenes	117			109/ 117					101/ 117	91/ 108	117/ 117	80/ 88	117/ 117	92/ 92	44/ 48	41/ 41*	116/ 117	83/ 83	---	99/ 99	117/ 117	116/ 117	55/ 58	76/ 86	115/ 117
Enterobacter cloacae	541			460/ 510					446/ 541	403/ 468	497/ 539	368/ 425	494/ 510	444/ 448	253/ 263	137/ 138*	513/ 535	346/ 359	---	357/ 359	526/ 541	472/ 485	247/ 249	322/ 365	493/ 541
Klebsiella pneumoniae	875		616/ 716	843/ 874	774/ 834	556/ 610	614/ 651	46/ 46	848/ 875	739/ 764	850/ 871	626/ 648	835/ 837	725/ 726	441/ 445	191/ 191*	834/ 870	602/ 624	---	640/ 644	829/ 875	748/ 795	297/ 338	565/ 640	787/ 875
Klebsiella oxytoca	355		239/ 322	344/ 355	184/ 330	252/ 272	244/ 252	---	342/ 355	299/ 308	346/ 355	269/ 289	355/ 355	278/ 278	190/ 190	110/ 110*	352/ 354	241/ 241	---	278/ 281	352/ 355	337/ 342	184/ 184	235/ 250	347/ 355
Proteus mirabilis	568	403/ 554	365/ 412	551/ 553	473/ 541	298/ 311	339/ 353	---	550/ 568	467/ 475	548/ 564	351/ 367	522/ 526	459/ 460		114/ 116*	446/ 565	350/ 422	---	391/ 397	519/ 568	436/ 471			416/ 553
Serratia marcescens	327			240/ 282					297/ 323	247/ 288	322/ 323	231/ 262	309/ 309	256/ 256	138/ 145	107/ 108*	295/ 309	227/ 238	---	226/ 229	321/ 327	265/ 298	151/ 159	15/ 228	313/ 323
Citrobacter freundii	149			145/ 149					127/ 149	119/ 138	148/ 149	109/ 125	149/ 149	135/ 135	65/ 66	50/ 50*	139/ 149	94/ 99	---	116/ 117	139/ 149	134/ 143	84/ 84	83/ 101	130/ 149
Morganella morganii	124		8/ 115	120/ 124			70/ 95	---	115/ 124	94/ 102	122/ 124	93/ 106	102/ 103	96/ 97		---	113/ 123	70/ 74	---	92/ 92	118/ 124	114/ 118	11/ 44	11/ 54	107/ 124
Pseudomonas aeruginosa	1208			1158/ 1208						1015/ 1091	1012/ 1109	740/ 927		824/ 882	621/ 699	271/ 288*	1036/ 1202	720/ 864		723/ 759	1030/ 1208	1046/ 1077			
Acinetobacter baumannii	115		92/ 110	27/ 35					62/ 115	83/ 98	74/ 91			78/ 80	---	---	94/ 115	70/ 80		60/ 63	101/ 115	105/ 115	---	65/ 73	96/ 115
Stenotrophomonas maltophilia	315									67/ 160								176/ 222							259/ 275
Haemophilus influenzae	385	263/ 385	26/ 29*			70/ 74			143/ 144					---			98/ 103	---	81/ 81*					52/ 61	109/ 160

Gram Positive Organisms	**Total Number of Isolates**	Penicillin	Ampicillin	Oxacillin	Ampicillin/Sulbactam	Cefazolin	Cefuroxime	Ceftriaxone	Ceftaroline	Levofloxacin	Moxifloxacin	Tetracycline	Trimethoprim/Sulfamethoxazole	Clindamycin	Erythromycin	Vancomycin	Linezolid	Daptomycin	Rifampin
Methicillin-**Sensitive** Staphylococcus aureus (MSSA)	6524	738/ 4866		5905/ 5907	5237/ 5279	4931/ 4940	---	4659/ 4666	399/ 399*	5978/ 6403	5629/ 5853	6238/ 6515	6442/ 6524	5141/ 6201		6524/ 6524	5729/ 5763	5315/ 5321	6163/ 6209
Methicillin-**Resistant** Staphylococcus aureua (MRSA)	3048								261/ 261*	1645/ 2994	1798/ 2726	2635/ 2994	2923/ 2994	1945/ 2882		3048/ 3048	2744/ 2775	2480/ 2483	2844/ 2879
Enterococcus faecalis	877	517/ 521	845/ 856		---											860/ 877	828/ 836	623/ 623	
Enterococcus faecium	149	18/ 111	41/ 148		---											63/ 148	139/ 145	112/ 120	
Enterococcus spp. *(all hospital data)*	1390	864/ 996	1220/ 1368		---											1264/ 1389	1260/ 1277	1023/ 1034	
Coagulase negative staphylococcus	1638	101/ 816		806/ 1427	431/ 888	473/ 932		359/ 708		1104/ 1500	981/ 1169	1386/ 1635	1101/ 1604	1068/ 1551		1628/ 1636	1224/ 1242	1169/ 1169	1405/ 1426
Streptococcus pneumoniae	439	370/ 416	---	---	---		160/ 190	341/ 367		289/ 295	95/ 96	248/ 295	237/ 277	174/ 191	207/ 307	315/ 316	55/ 55*		

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New Hampshire Statewide Antibiogram 2016

Urine Only Sources

Percent Susceptible

		Percent Susceptible																					
Gram Negative Organisms	**Total Number of Isolates**	Ampicillin	Piperacillin/Tazobactam	Cefazolin	Cefuroxime	Cefoxitin	Ceftriaxone	Ceftazidime	Cefepime	Aztreonam	Ertapenem	Meropenem	Imipenem	Doripenem	Ciprofloxacin	Levofloxacin	Amikacin	Gentamicin	Tobramycin	Tigecycline	Tetracycline	Trimethoprim/Sulfamethoxazole	Nitrofurantoin
Escherichia coli	24330	66	96	91	95	96	96	96	97	96	97	100	100	100*	87	86	96	94	95	100	81	83	98
Enterobacter aerogenes	374		91				86	89	99	92	99	100	94	100*	99	99	100	100	100	99	94	99	19
Enterobacter cloacae	681		85				79	82	94	84	94	99	97	100*	94	95	100	98	97	95	86	84	30
Klebsiella pneumoniae	4600		98	96	94	95	97	97	98	97	100	100	100	100*	97	98	100	98	98	98	86	93	46
Klebsiella oxytoca	687		94	50	88	98	95	97	97	95	100	100	100	100*	97	98	99	99	97	99	94	95	85
Proteus mirabilis	1620	76	100	90	98	98	98	99	98	97	100	100		99*	78	80	99	90	92			78	
Serratia marcescens	262		88				90	86	98	88	100	100	99	100*	94	97	99	99	90	96	3	98	
Citrobacter freundii	624		96				82	83	100	86	100	100	85	100*	95	96	99	96	96	99	85	89	95
Morganella morganii	218		99			81	92	87	97	90	100	99		95*	87	87	97	90	94	11	14	84	
Pseudomonas aeruginosa	1220		97					95	92	82		93	86	98*	79	77	97	86	94				
Acinetobacter baumannii	84		---				56	91	93			77	---	---	95	90	95	99	98	---	85	85	

Gram Positive Organisms	**Total Number of Isolates**	Penicillin	Ampicillin	Oxacillin	Cefazolin	Ceftriaxone	Ceftaroline	Levofloxacin	Tetracycline	Trimethoprim/Sulfamethoxazole	Clindamycin	Vancomycin	Linezolid	Daptomycin	Rifampin	Nitrofurantoin
Methicillin-**Sensitive** Staphylococcus aureus (MSSA)	591	24		97	100	100	100*	78	97	99	82	100	100	100	100	100
Methicillin-**Resistant** Staphylococcus aureua (MRSA)	401						100*	19	97	98	52	100	100	99	98	99
Enterococcus faecalis	2612	97	97									99	98	100		98
Enterococcus faecium	200	24	25									40	97	93		44
Enterococcus spp. *(all hospital data)*	4015	92	93									97	99	92		95

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Total Number of Susceptible Isolates/Total Tested

Gram Negative Organisms	**Total Number of Isolates**	Ampicillin	Piperacillin/Tazobactam	Cefazolin	Cefuroxime	Cefoxitin	Ceftriaxone	Ceftazidime	Cefepime	Aztreonam	Ertapenem	Meropenem	Imipenem	Doripenem	Ciprofloxacin	Levofloxacin	Amikacin	Gentamicin	Tobramycin	Tigecycline	Tetracycline	Trimethoprim/Sulfamethoxazole	Nitrofurantoin
Escherichia coli	24330	15179/ 23121	23281/ 24324	22032/ 24181	15955/ 16879	14044/ 14640	23248/ 24321	18983/ 19865	23069/ 23750	18267/ 18981	22688/ 23406	17626/ 17639	11744/ 11755	6181/ 6182*	21017/ 24173	15191/ 17565	15267/ 15876	22772/ 24329	20316/ 21435	11397/ 11402	12681/ 15745	20187/ 24328	23851/ 24329
Enterobacter aerogenes	374		339/ 374				320/ 374	269/ 304	372/ 374	296/ 321	371/ 374	273/ 273	175/ 186	90/ 90*	370/ 373	252/ 255	283/ 284	374/ 374	362/ 363	193/ 195	209/ 223	369/ 374	70/ 374
Enterobacter cloacae	681		578/ 681				535/ 680	463/ 563	626/ 665	451/ 538	627/ 664	483/ 490	175/ 294	198/ 198*	638/ 676	450/ 475	517/ 519	663/ 680	636/ 655	337/ 353	383/ 448	573/ 681	207/ 681
Klebsiella pneumoniae	4600		4401/ 4496	4396/ 4594	2945/ 3142	2572/ 2694	4474/ 4599	3570/ 3666	4435/ 4537	3503/ 3599	4302/ 4311	3471/ 3478	2135/ 2138	1136/ 1136*	4422/ 4568	3200/ 3279	3102/ 3110	4528/ 4600	3923/ 4002	2126/ 2176	2595/ 3004	4270/ 4600	2102/ 4600
Klebsiella oxytoca	687		643/ 687	345/ 685	443/ 504	429/ 440	650/ 686	570/ 585	655/ 672	521/ 550	674/ 674	495/ 497	327/ 327	190/ 190*	659/ 680	457/ 466	509/ 512	678/ 687	647/ 665	356/ 359	423/ 449	655/ 687	582/ 687
Proteus mirabilis	1620	1178/ 1554	1612/ 1620	1454/ 1615	1070/ 1090	934/ 957	1581/ 1619	1312/ 1329	1567/ 1595	1148/ 1183	1524/ 1525	1175/ 1175		383/ 386*	1257/ 1614	970/ 1213	1039/ 1049	1458/ 1620	1280/ 1392			1269/ 1620	
Serratia marcescens	262		207/ 235				236/ 262	189/ 219	258/ 262	181/ 206	252/ 252	206/ 206	68/ 69	91/ 91*	242/ 257	167/ 173	211/ 214	255/ 258	219/ 243	134/ 140	6/ 169	253/ 258	
Citrobacter freundii	624		597/ 624				511/ 624	452/ 544	622/ 624	420/ 489	591/ 591	468/ 468	217/ 256	202/ 202*	588/ 621	433/ 450	469/ 472	596/ 624	546/ 569	342/ 347	365/ 427	555/ 624	595/ 624
Morganella morganii	218		215/ 218			101/ 125	200/ 218	153/ 177	211/ 218	147/ 163	217/ 218	151/ 152		62/ 65*	187/ 216	122/ 140	174/ 179	196/ 218	199/ 212	9/ 81	18/ 128	183/ 218	
Pseudomonas aeruginosa	1220		1180/ 1219					1056/ 1114	906/ 989	649/ 796		851/ 914	399/ 465	284/ 290*	964/ 1213	652/ 847	743/ 764	1047/ 1220	987/ 1047				
Acinetobacter baumannii	84		---				47/ 84	67/ 74	64/ 69			41/ 53	---	---	80/ 84	55/ 61	58/ 61	83/ 84	82/ 84	---	53/ 62	71/ 84	

Gram Positive Organisms	**Total Number of Isolates**	Penicillin	Ampicillin	Oxacillin	Cefazolin	Ceftriaxone	Ceftaroline	Levofloxacin	Tetracycline	Trimethoprim/Sulfamethoxazole	Clindamycin	Vancomycin	Linezolid	Daptomycin	Rifampin	Nitrofurantoin
Methicillin-**Sensitive** Staphylococcus aureu	591	119/ 494		528/ 542	346/ 347	378/ 380	64/ 64*	455/ 580	573/ 591	587/ 591	135/ 164	591/ 591	489/ 489	393/ 393	525/ 527	590/ 591
Methicillin-**Resistant** Staphylococcus aureu	401						50/ 50*	71/ 373	374/ 387	378/ 387	64/ 122	386/ 387	371/ 372	280/ 283	367/ 373	384/ 387
Enterococcus faecalis	2612	1798/ 1856	2534/ 2612									2586/ 2611	2313/ 2351	1997/ 1997		2527/ 2578
Enterococcus faecium	200	50/ 197	50/ 197									65/ 161	192/ 197	149.95/ 162		88/ 200
Enterococcus spp. *(all hospital data)*	4015	2965/ 3215	3718/ 4012									3836/ 3975	3476/ 3525	2893/ 3136		3762/ 3981

Indicates data have been censored because of intrinsic resistance and/or inappropriate clinical use.

--- Indicates data have been censored because of insufficient sample. CLSI guidelines suggest total isolate counts of less than 30 are excluded.

* Indicates data for which 3 or less hospitals reported and result may not be geographically representative.

Methodology:

Reporting Requirements:

Reporting requirements are governed by RSA 141:C6 with authority given to DHHS to develop administrative rules to provide specific reporting instructions and methodology. Administrative rules He-P 301 were adopted in fall 2016 "He-P 300 Diseases, PART He-P 301.02 Communicable Diseases," were updated in 2016 with stakeholder input and approved by the Joint Legislative Committee on Administrative Rules. The updated rules require hospital laboratories to report antibiogram data annually to the State of New Hampshire.

Collection Process and Validation:

NH DPHS developed a standardized antibiogram fillable form for reporting susceptibility data, and requested data from hospital microbiology laboratories in spring 2017. This form was developed to encompass most relevant antibiotic and organism combinations and was done by consultation of both NH DPHS and stakeholder subject matter experts. All 26 NH hospitals reported antibiogram data as required under He-P301; however three hospitals were excluded from analysis due to facility capacity limitations and an inability to separate urine and non-urine isolates.

The HAI Program reconciled data to confirm reported data and evaluate accuracy and reliability of the data. The HAI Program first conducted an internal assessment to identify outliers or implausible data by comparing the percent susceptibilities between all hospitals for every organism and antibiotic combination and then corrected or confirmed data with each respective microbiology laboratory. The program subsequently convened an infectious disease medical and pharmacy advisory group to review the clinical implications of the data and ensure data was clinically accurate and relevant. The advisory group determined which antibiotic-organism combinations to censor due to clinical inappropriateness. Lastly, the antibiogram data was reviewed by the NH Antimicrobial Resistance Advisory Workgroup (ARAW)[1] to provide feedback and suggestions for use.

Antibiogram Development:

The NH DPHS complied with the Clinical and Laboratory Standards Institute (CLSI) manual in creating and aggregating data from all reported hospital antibiograms. Antibiotic and organism combinations that are either intrinsically resistance or are not clinically appropriate were censored from the antibiogram. Per CLSI guidelines, any antibiotic and organism combination with a total number of isolate counts of less than 30 isolates are excluded. As noted in the footnotes of the antibiogram, data points in which less than 3 hospitals reported are marked with an asterisk, as they may not be geographically representative.

An Antimicrobial Resistance Advisory Workgroup subcommittee, made up of infectious disease clinical specialists, drafted and reviewed the antibiogram executive summary to assist with clinical interpretation. The summary was created on the basis of clinical syndromic conditions and pulled recommendations for treatment based on antibiogram data collected.

[1] ARAW is a group of subject matter experts and stakeholders across the State of New Hampshire who meet regularly to discuss and work to combat issues of antimicrobial resistance in NH. This is a forum for stakeholder input facilitated by NH DPHS.

Data Limitations:

- Methods to report and collect data by hospitals labs varied. Some labs pulled data directly from their antibiotic susceptibility testing instrument (i.e. Microscan or Vitek), while other labs pulled data from their lab information system.
- Antibiotic susceptibility data from regional reference labs is not represented in this data set and therefore the antibiogram is limited in its representativeness to hospital laboratory isolates.
- The urine only antibiogram includes all urine isolates, not necessary only those pertaining to urinary tract infections. These isolates may represent other types of infections where bacteria were cultured from other clinical isolates in addition to the urine (e.g. bacteremia with seeding of the urine).
- The lack of reported susceptibility results for an antibiotic against a specific organism doesn't necessarily mean that the antibiotic isn't active. In some cases activity is reliably predicted by the activity of another agent (e.g. cefazolin activity against *Staphylococcus aureus* is predicted by oxacillin susceptibility); while in some other cases it is not possible to test susceptibility due to lack of testing reagents. Conversely, reported activity on *in vitro* susceptibility results does not necessarily mean an agent is clinically effective (or as effective as alternatives). For example, ciprofloxacin may show *in vitro* activity against *Staphylococcus aureus*, but ciprofloxacin should never be used to treat infections caused by this organism. This is because of the potential for rapid development of resistance while being treated with ciprofloxacin.

Note: All the data in this report are based upon information provided to the New Hampshire Department of Health and Human Services under specific legislative authority. The numbers reported may represent an underestimate of the true absolute number in the state. Any release of personal identifying information is conditioned upon such information remaining confidential. The unauthorized disclosure of any confidential medical or scientific data is a misdemeanor under New Hampshire law. The department is not responsible for any duplication or misrepresentation of surveillance data released in this report. Data are complete as of 12/8/17. Report prepared by the Healthcare-Associated Infections Program, Infectious Disease Surveillance Section, haiprogram@dhhs.nh.gov, (603)-271-4496.

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